System for Employing Nano-RFID in Support of Automated Retail Checkout System Not Dependent Upon Weighing Items or Tracking Faces

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Introduction

Given the capability of manufacturing RFID units on the nanometer scale, each capable of storing substantial data and functioning based upon the principle of harmonic-conditional transmission as well as cumulative signal strength, it is possible to affordably mass-produce these nano-RFID tags and to use them to support a system for automatically and efficiently registering product selections in support of the retail checkout process.

Embedding chips within product packaging is a costly enterprise, generally requiring melting a small section of the packaging and adding a chip to the product under high-heat conditions. This, in turn, creates a requirement for the chip to be heat-resistant, further driving up the manufacturing cost.

Abstract

I propose adding tens of thousands of nano-RFID chips to a suspension consisting only of the chips themselves and paraffin wax. The wax, which has a relatively low melting point, would contain and solidify around the chips, largely preventing their unintentional spread in any meaningful quantity to other products.

Small beads of this warm, transparent wax would be smeared on the side of product packaging in a randomized position, covering an area of about one square millimeter. Wax, which is waterproof, would be unlikely to be washed away by accident and would be difficult to spot by someone wishing to remove the UPC-identifying chips to facilitate the purloining of merchandise.

Rather than counting the number of individual chips detected to ascertain the intended quantity purchased, as that number would naturally vary by 10% or more, the RFID detector would be able to count the number of distinct waxy areas in a cart or basket. This would be achieved by enabling the reader mechanism to assess the spatial position of the RFID clusters in three dimensions using time-of-flight analysis and without the need for radio direction finding in the traditional sense. Since each tag is placed in a different position on the packaging and has a surface area of less than 1mm, two boxes of crackers, for instance, even if wedged closely together in a basket, would in almost all cases return two distinguishable signals.

Two different UPC codes that are coming from different points in an area that are equidistant from the detector would still be easily distinguished as modern radio detectors can easily sort out two different signals using both digital analysis and frequency differentiation. Products from different manufacturers could be tagged with RFID clusters operating at unique frequencies to further reduce the risk of a fault.

To further increase the accuracy of the system, optionally, a degree of three-dimensional resolution of relative position can be attained by using a blend of single-frequency-triggered and dual-frequency triggered chips in the paraffin suspension.

With a dual-frequency triggering requirement to cause chips to emit their own signal, the chips would have two individual circuits each of which has its own power receiving antenna, each of which only absorbs radio-delivered power from a particular range of frequencies. The second circuit is capable of being powered only by another, distinct range of EM. Only when both frequencies are present would transmission be triggered from those chips, which would make up about 50% of the chips. By analyzing the difference between the time of flight of the single and dual-frequency triggered elements, even clusters that are very near to each other would be easily distinguished by the system since the secondary frequency generator in the scanner would be positioned some distance away from the other generator.

Conclusion

With this system, double scans and failures to scan would be highly unlikely and costs would be substantially lower than those associated with Amazon's or H-E-B's automated checkout systems. There would be no need for shoppers to log in to an application prior to shopping, nor would there be a need to print QR codes on the sides of baskets. This is a system that preserves the shopper's privacy by eliminating the need for ubiquitous cameras and requires the shopper only to park their cart within the scanning area and to press a button to trigger a scan, check a readout for accuracy, and to insert their card when ready. Shoppers attempting to roll beyond a certain point without paying would trigger an alarm since the absence of RFID transmission from the scanning area would be noticed by the system, which passively scans at all times to assure product is not removed prematurely.